INTRODUCTION

Localized flooding and road damage can occur if drainage systems are not properly designed. The Utah Department of Transportation (UDOT) had the HYDRAIN computer library standardized on the U.S. Federal Highway Administration (FHWA) for conducting drainage calculations. However, this suite of computer programs is DOS-based and can be difficult to use effectively by consultants and UDOT engineers. In addition, HYDRAIN does not provide a conventional geographical information system (GIS) module for estimating watershed parameters. The HYDRAIN software currently available does not interface directly with the MicroStation Computer Aided Design (CAD) system being used throughout UDOT. The Hydraulics Division believes that productivity and accuracy could be increased by improving the culvert module and by identifying an improved hydraulic design software program.

Therefore, this project was initiated to develop and select advanced computer programs to improve roadway hydraulic and hydrologic design tools available for use by UDOT engineers and consultants. The development and selection of such computer software that uses engineering analysis and interactive graphics is expected to reduce design and production times and improve quality control.

PROJECT OBJECTIVES

Project objectives were developed under the guidance of the UDOT Technical Advisory Committee (TAC). Members of the TAC for the project included:

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The original scope of work for the project was established in July 1998. The general objectives of the project follow:

) Produce a prototype module for the analysis of culvert hydraulics, including enhanced functionality requested by UDOT.

2) Survey the functionality of the ArcView GIS software for application to hydrologic estimates.

SPECIFIC OBJECTIVES AND TASKS

Objective 1:

Produce a prototype module for the analysis of culvert hydraulics and energy dissipaters.

Task 1. Develop a prototype computer module for culvert hydraulics that incorporates the specific functionality requested by UDOT hydraulic engineers, including adjusted invert, inlet control, outlet control, critical flow, normal flow, full barrel flow, water surface profiles, and energy dissipaters.

Task 2. Provide a user's manual and training for computer module.

Task 3. Provide beta testing and focus group critique of the software products.

Objective 2:

Survey the functionality of the ArcView GIS software for application to hydraulic design.

Task 1. Conduct a survey of features of ArcView as they relate to the use of digital terrain maps (DTMs) for estimating runoff and stream flow conditions for culvert design.

Task 2. Present a summary of features that would be most useful for UDOT design engineers.

REVISED OBJECTIVES AND TASKS

Work progressed on the tasks, and presentations were made at two TAC meetings during summer and fall 1998. A workshop was held at a University of Utah computer laboratory in October 1998 for a group of UDOT hydraulic engineers to critique the prototype model.

At a TAC committee meeting on Jan. 22, 1999, two presentations were made:

) Features of ArcView for potential use by UDOT for hydraulic design

2) Revisions to the prototype hydraulic model based on recommendations from the fall workshop.

The TAC engaged in prolonged discussions on the use of ArcView and other GIS products, and decided that it would be impractical for each UDOT hydraulic design engineer to become sufficiently skilled in the use of ArcView to apply it to their day-to-day activities. The committee members believed that GIS software specifically tailored for hydraulic design was available commercially. The TAC committee recommended a shift of the remaining project resources as follows:

1) Discontinue work on the prototype hydraulic model (Objective 1).

2) Discontinue work on the assessment of ArcView (Objective 2).

3) Conduct a survey of the commercial GIS software products available specifically for hydraulic design (New objective).

The new objective was further defined as follows:

Objective 3:

Survey hydraulic design software products that have the potential to interface with UDOT roadway design procedures and standards and recommend one for use by UDOT.

Task 1 Conduct a survey of hydraulic software products that currently are available and have the potential to support UDOT roadway design procedures and standards.

Task 2 Present a summary of features of selected software products and recommend use of one for UDOT.